

*Rhine-Meuse delta studies*

## **RIVER MOUTH DROWNING UNDER RAPID SEA LEVEL RISE: RHINE DELTA GEOLOGICAL LESSONS**

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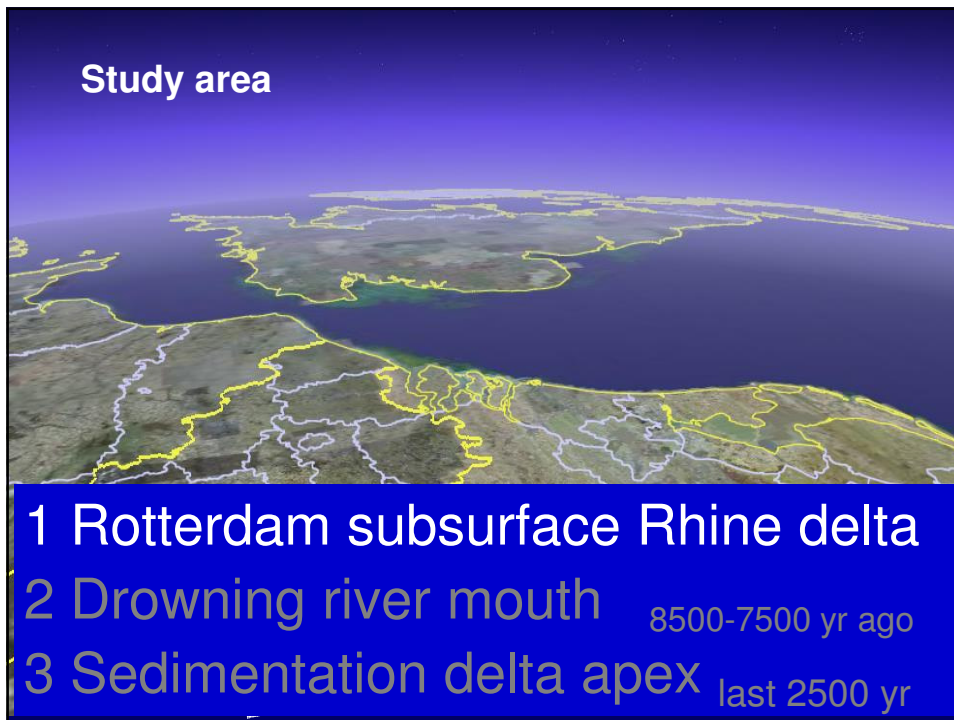
**Utrecht University**

*Faculty of Geosciences*

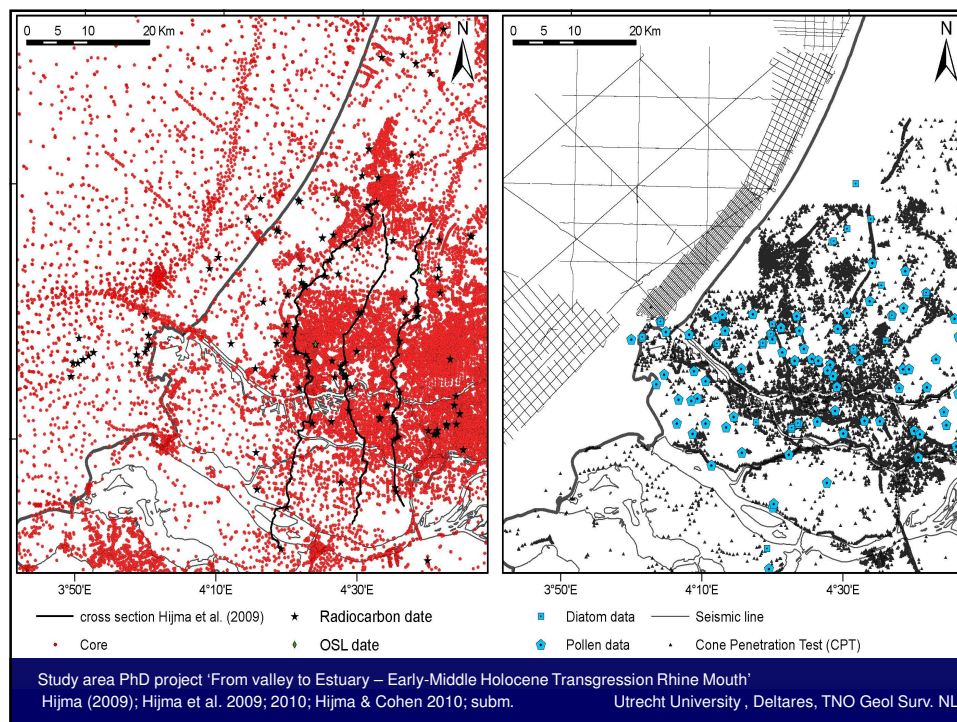
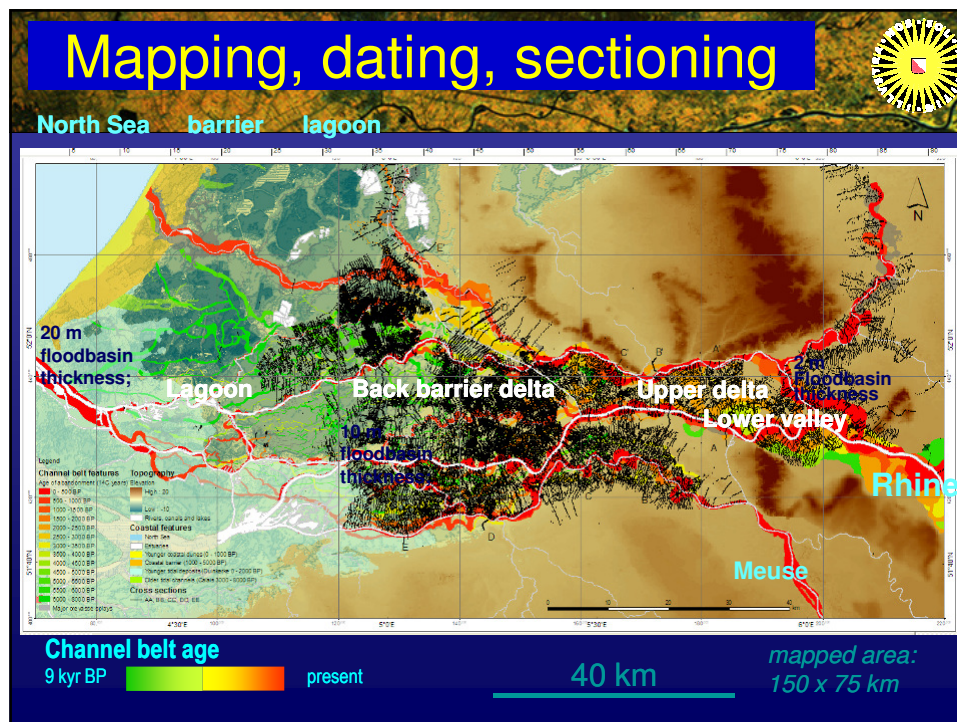
*Department of Physical Geography*



### **Study area**

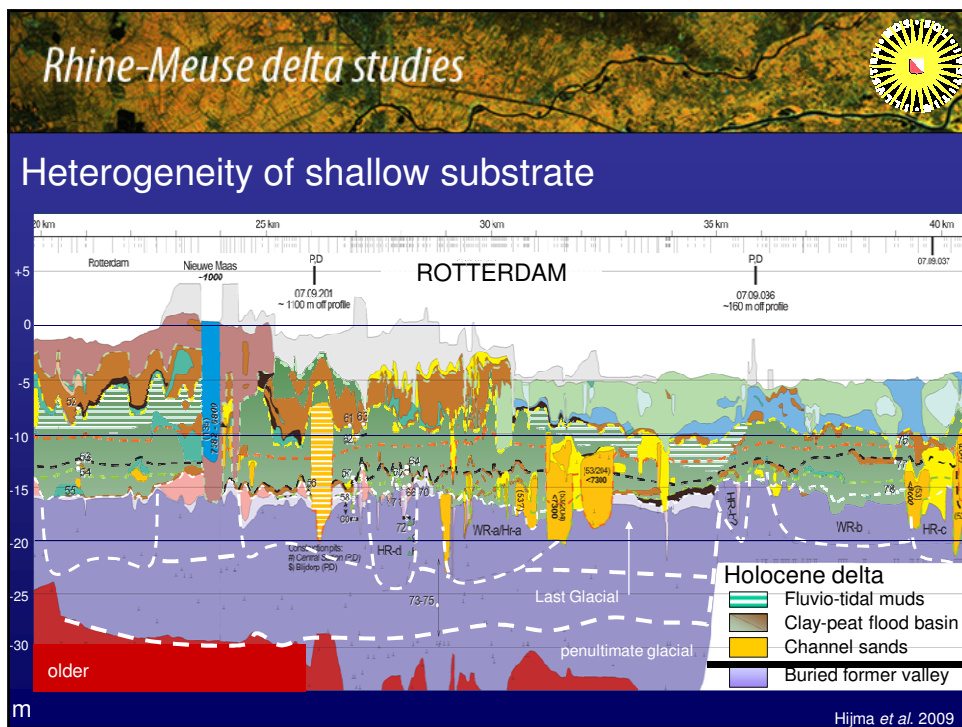
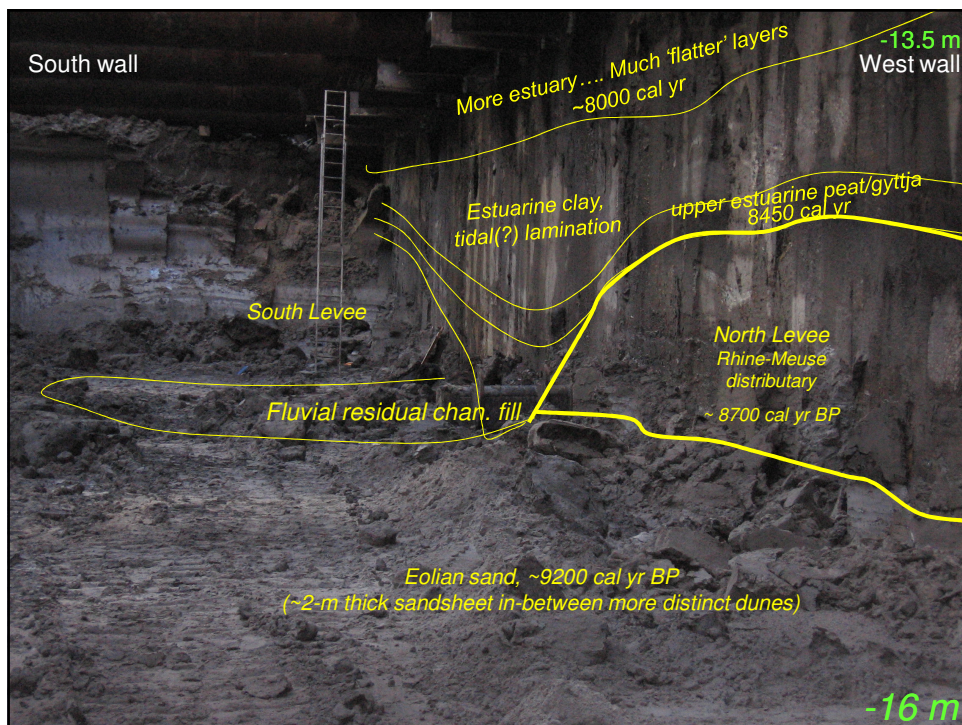


- 1 Rotterdam subsurface Rhine delta
- 2 Drowning river mouth 8500-7500 yr ago
- 3 Sedimentation delta apex last 2500 yr

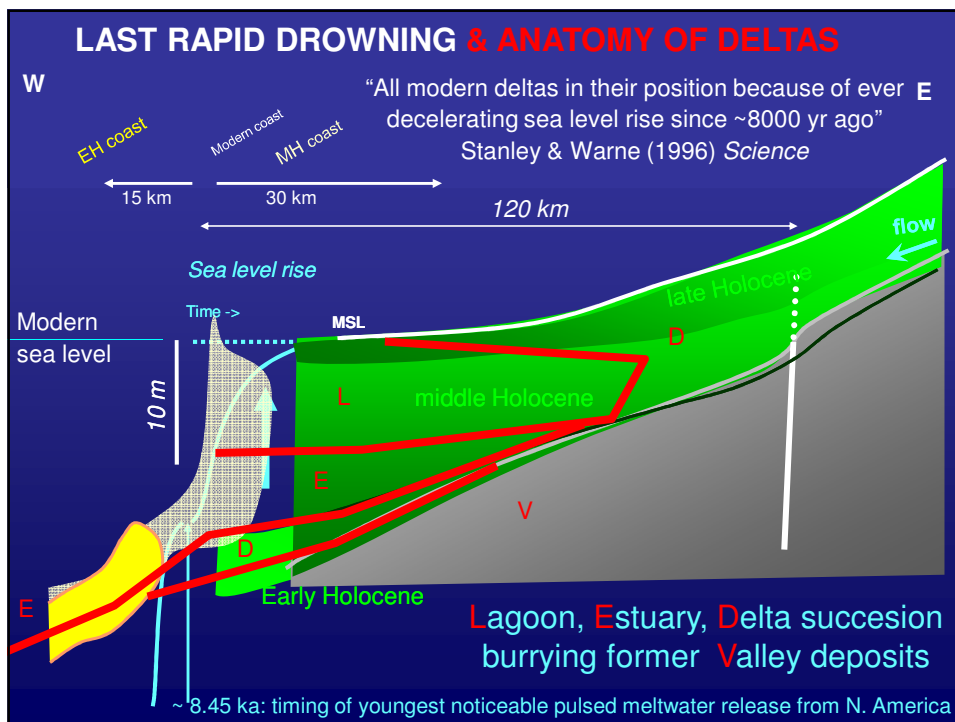
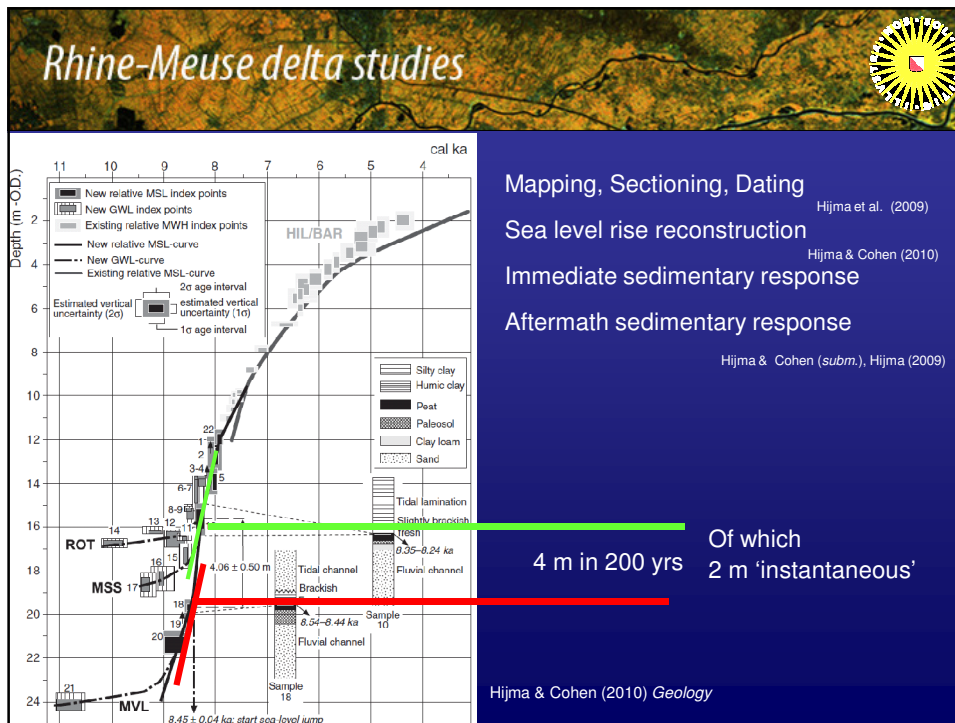


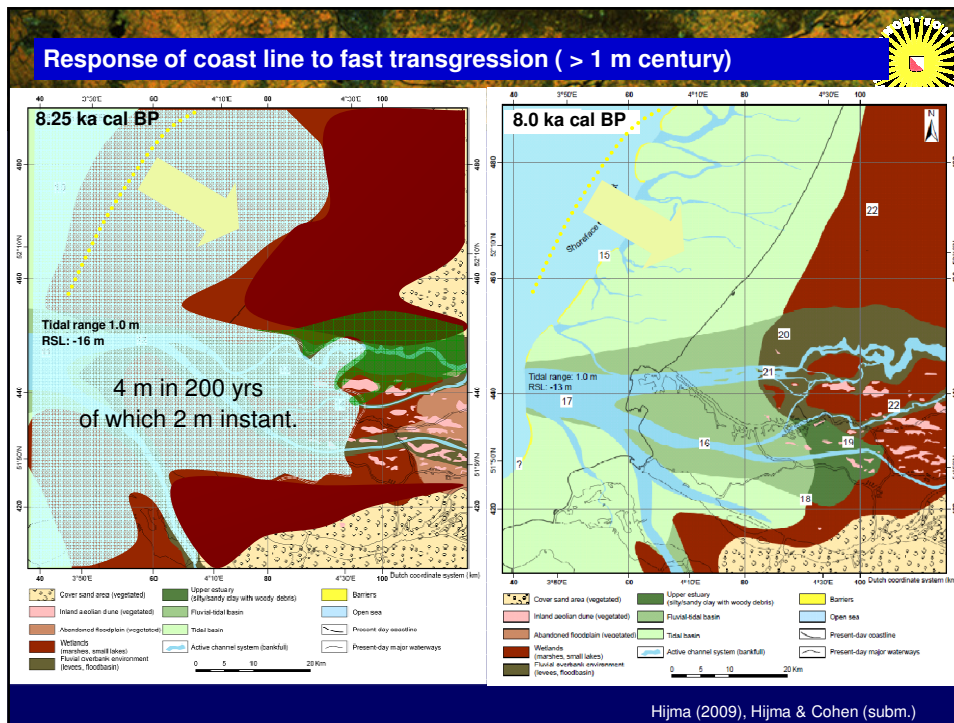












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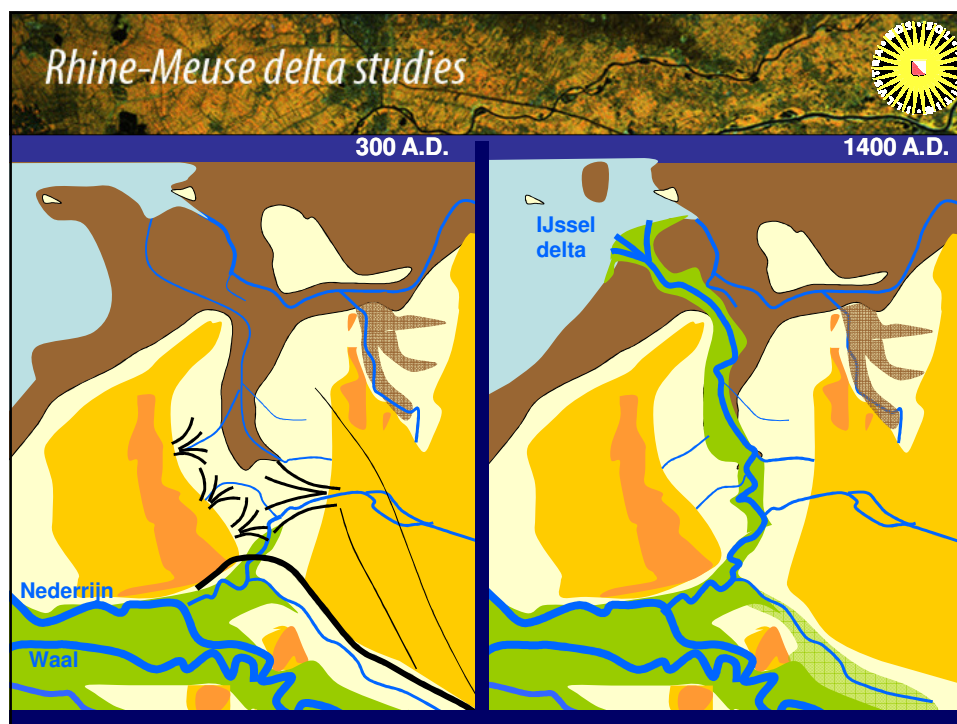
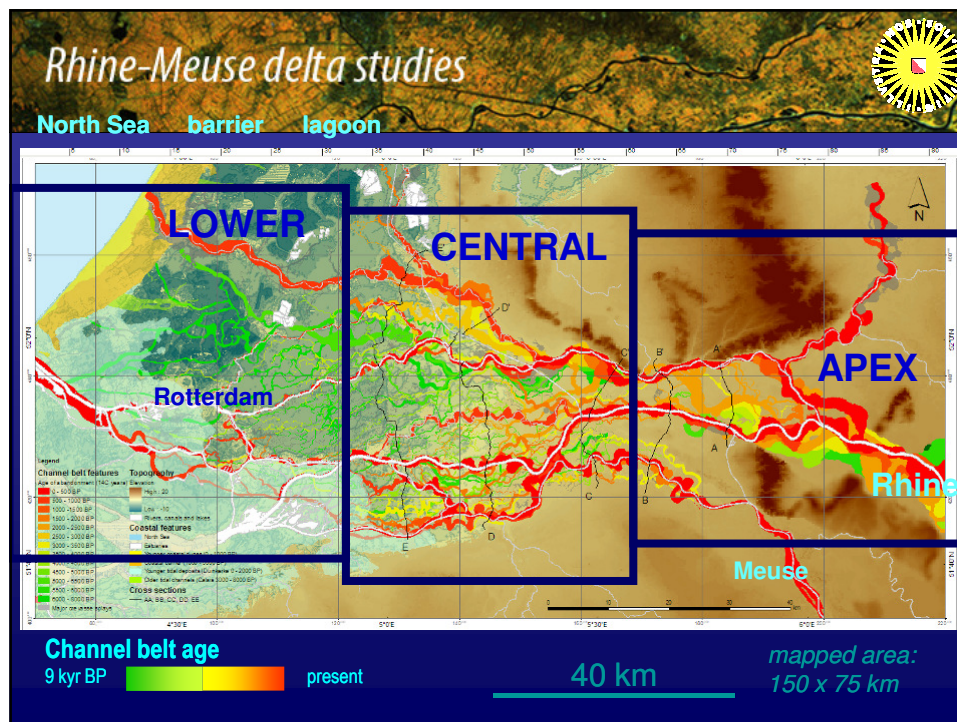
**Common delta theory,**  
i.e. our rules-of-thumb for coast line change, engineering practice,  
river mouth geological wisdom

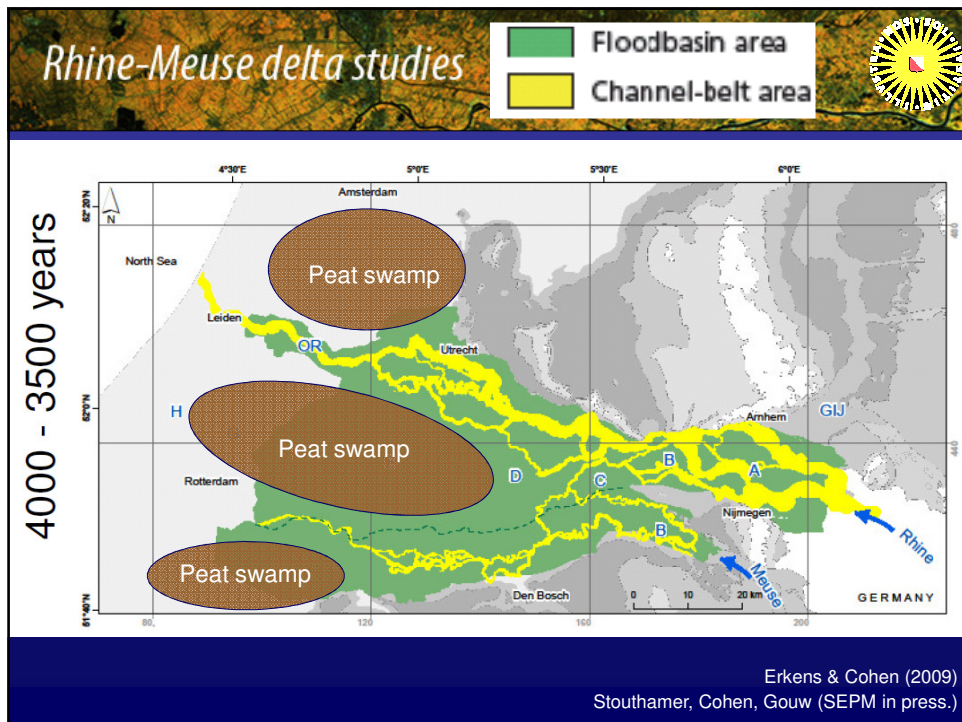
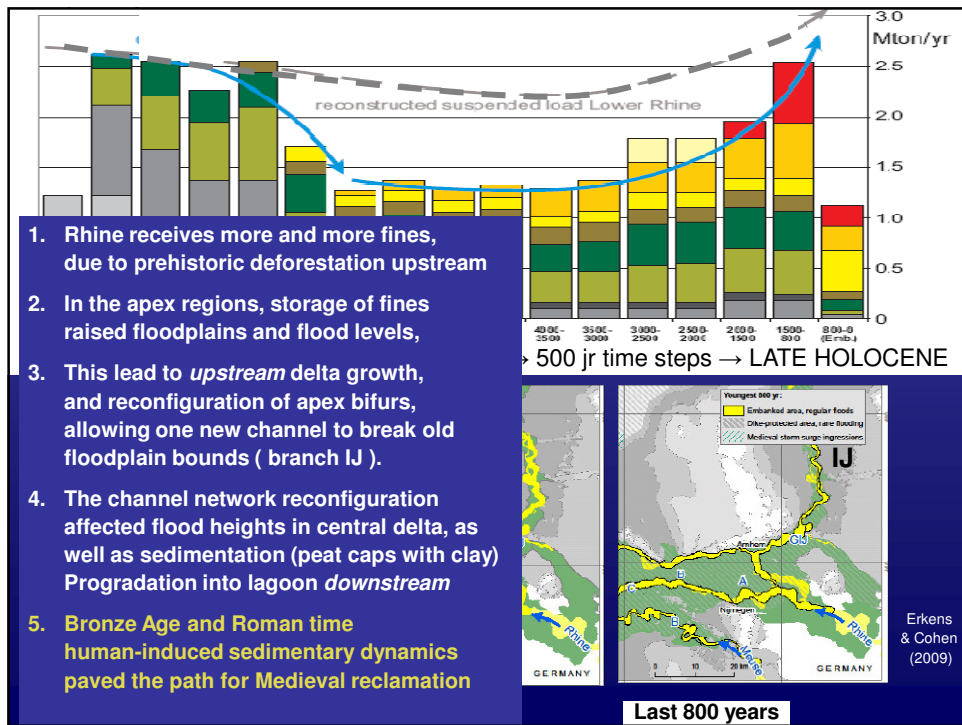
**Is stongly biased to 'modern deltas'**  
that have build out in a hardly rising sea for 6000 years or so.

**Rapidly drowning river mouths are different beasts**  
Shows the base of the Rhine delta,  
as show the bases of many deltas.

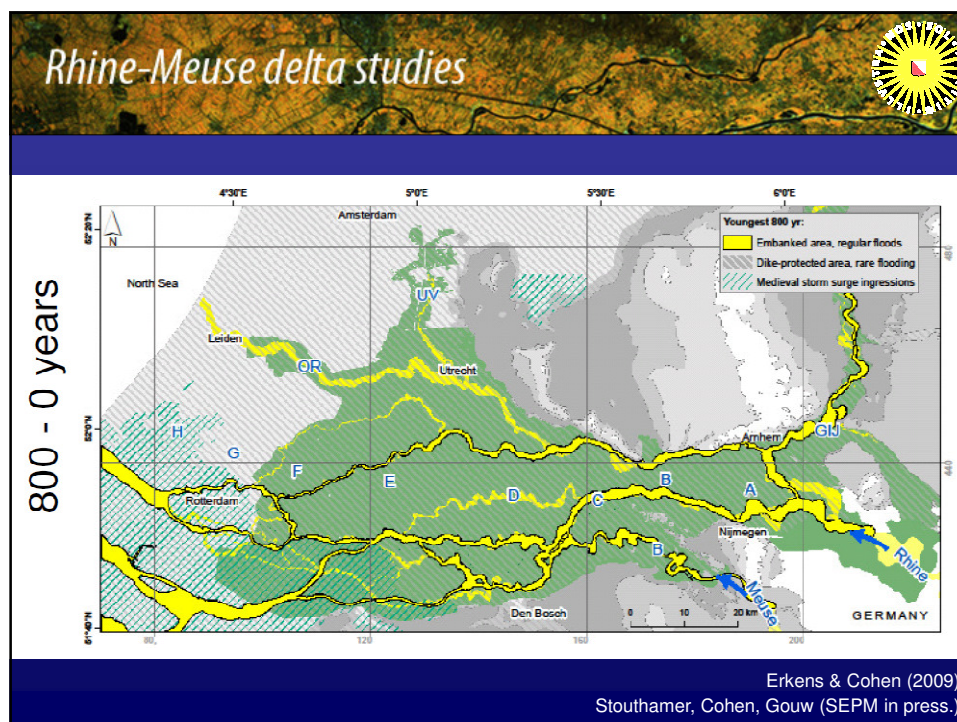
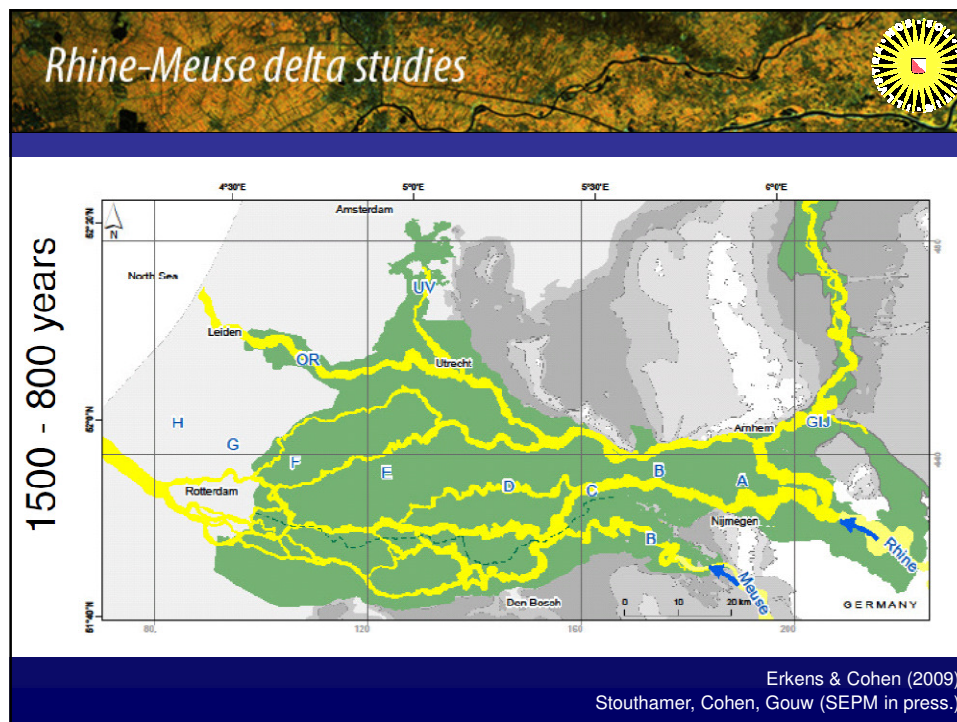
**This is of particular importance in assessments  
of resilience of major semi-natural deltas  
under presently accelerated sea level rise**













## Sediment supply to deltas

- Apex region: efficient natural delta sediment trap
- Channel re-configuration due to delta apex response to increased sediment flux from prehistoric agri-erosion
- Foundation of success of Netherlands' delta reclamation.
- The Rhine delta was unnatural long before the first dike: Man was a factor of geological importance since ~3000 yr

*'Are Deltas Sinking?' Syvitski et al. 2010 Nature Geosciences – 20<sup>th</sup> century sediment frustration*

**Sediment space-time budgets and reclaimed-land maintenance:  
Netherlands' delta = a look in the future for other deltas**



## CONCLUSION / MAIN LESSONS:

### **1. River mouth under rapid sea level rise**

Response in first 100-1000 yrs is not captured in common 'delta sedimentary functioning' models

Coastal zone substrate determines aftermath.

### **2. Erosion is a problem for hinterland inhabitants, but for delta inhabitants has been very profitable**

In a natural delta: apex is sedimentation depo-centre

In a rural-urban delta: potential for sediment management.

**Holocene Rhine delta evolution:** completely documented drawer with example cases





**23 floors down? 30 floors down!**

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